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In a study on short term memory, 32 educable mentally retarded subjects (mean IQ 62.68, mean mental age 103.78 months) were randomly assigned to each of the four experimental conditions. An automated machine presented the stimuli (32 three-letter words) and the interference items (a list of random numbers read aloud between stimuli presentations). Intervals were 3 seconds, 9 seconds, and 18 seconds respectively for the first time order in which one group read the word aloud (vocal condition) and another group thought it silently (silent condition). The two groups in the second time order were divided the same way but the sequence of time intervals was reversed. M&M candy reinforced correct responses. The predicted depressed curves were obtained for the silent condition with both orders. The main effects of order and vocalization were significant (p .01); the reversed time order groups produced more correct responses and shorter response latencies (p .05); and the vocal condition subjects had the greater number of correct responses (p .05) and a shorter response time (p .01). It is suggested that in forcing subjects to hold material in memory for a longer period of time, a longer storage memory system may have been utilized which functions better for retardates than the short term memory system. (SN)

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Effects of a Set for Delayed Response on Recall by MR's

Sue Seitz and Dan Morris

Austin State School

Austin, Texas

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The Effects of a Set for Delayed Response on Recall by MR's

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The problem of short-term memory (STM) in the MR continues to be one of paramount interest to investigators in this area as the recent review of theory and research by Scott & Scott (1968) testifies.

Ellis (1963) has postulated and obtained evidence for the theory that MRs are deficit in STM. Timing, therefore, of the response interval becomes a parameter of consideration in preparing programmed materials.

Various approaches to studying the effects on STM of interfering materials and intradurations are currently reported for both normal and retarded Ss (Cofer & Davidson, 1968; Corman & Wickens, 1968; and Ellis & Anders, 1968).

An applied note was sounded by Gallegos (1966) in a study comparing experimenter pacing and student pacing programmed instruction. Her data indicated that low ability subjects were unable to determine for themselves the most appropriate rate for proceeding with material. These subjects were not mentally retarded, however, and a systematic investigation of various intervals was not examined.

For this pilot study we adopted as a departure point one which has served many authors well, the classical 1959 Peterson & Peterson study on short-term retention.

Peterson & Peterson reported a mean latency for correct responses of 2.83 seconds and presented a series of cumulatively correct response curves whose order directly corresponds to the interference interval between the stimulus and response, with poorest performance associated with the longest (18 seconds) intratrial interval.

We added one condition to this design in that we also reversed the order of presentation of interference intervals by beginning subjects with an 18-second interval and moving to a 3-second interval, in order to examine the possibility that subjects might perform differently under the reversed conditions. We predicted that the curves produced following Peterson's procedure would retain the same order, but that the per cent correct in each condition would be lower. No hypothesis was formulated concerning the reverse condition.

Method

Subjects. Thirty-two educable MR's at the Austin State School served as Ss in this experiment. The Ss ranged in IQ from 43-75, with a mean of 62.68. The mean MA was 103.78. Eight Ss were randomly assigned to each of the four experimental conditions.

Apparatus. The MTA sr-400 Scholar, an automated machine for the presentation of printed programs, was used to present the stimuli and the interference items. The stimulus items were 32 three-letter words which could be read by each S. The interference items were lists of random numbers to be read aloud by the S between presentation of stimulus items.

Procedure. The Order I Ss were presented a word on the machine for two seconds and instructed to read it aloud (Vocal condition) or to think it silently (Silent condition). On the first trial, the machine was then advanced to a blank space for a period of three seconds. The machine was again advanced to a question mark and the S instructed to recall the stimulus word. A list of eight words was presented in this manner. On subsequent trials in the response delay interval, the machine advanced to a list of random numbers which the S was instructed to read aloud for the duration of the interval. The interference intervals were three seconds, nine seconds, and 18 seconds, respectively, for the remaining three trials.

The sequence of time intervals was reversed for Order II Ss, going from the 18-second interference interval to the three-second non-interference interval, a condition not employed in the Peterson & Peterson study.

Each S was rewarded with an M & M for every correct response, and the response time for each stimulus item recall was recorded by stop watch.

The result is a 2 x 2 x 3 factorial design: The main effect variables are order of presentation of interference intervals, silent reading versus vocalization of the stimulus items, and the length of the interference interval.

Results and Discussion

The only support for the hypothesis is found in the depressed curves of the Silent condition and the prediction that Ss in this treatment group would not reach the 80% cumulative correct curve, but would produce lower response curves (Figure 1). Nearly all groups in this study required 12 seconds latency to reach a plateau, whereas in the Peterson Study most curves reach asymptote in ten seconds (Figure 1, Figure 2).

Insert Figure 1, Figure 2 about here

Response latencies and correct responses for all 12 of the interference conditions were compared statistically by analysis of variance. The no-interference conditions were omitted from this analysis since Ss in these groups reached the 90% and 100% correct response levels.

The analysis of correct responses (CR) showed the main effects of Order & Vocalization (Table 1) to be significant ($p < .01$)

Insert Table 1 about here

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with Order II producing significantly more correct responses. The Vocal group was overall superior to the Silent group. The interaction of these two treatments produced a significantly greater number of correct responses in the Order II, Vocal condition ($p < .05$, Table 2).

Insert Table 2 about here

While the Peterson data showed a tendency for the proportion of items correctly recalled to be greater for the Vocal than for the Silent group, this did not reach a significant level, as is the case in the present study. This may be due to the fact that the normal subjects' performance was high under the Silent condition, leaving so little room for improvement that the increment produced by vocalization did not make a difference that was statistically significant. For the retarded student, however, such was not the case.

Figures 1 and 2 show all curves for the Vocal condition achieving the 75% or greater level, whereas in the Silent condition only one curve where interference is present lies above the 75% mark. Vocalization really achieves a triple association with the stimulus word: the sight of the word--visual; the vocalization--kinesthetic; and the auditory. Triple presentation of the stimulus apparently increased the number of correct responses in all Vocal conditions above their counterpart Silent conditions.

The analysis of variance for response latencies (Tables 3 & 4)

Insert Tables 3 & 4 about here

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showed the Vocal condition to produce a significantly shorter response time ($p < .01$). A faster response was also seen as a function of Order, with Order II producing significantly shorter latencies ($p < .05$). The significant VxO interaction was the result of the improvement in the Order I condition as a function of vocalization. The significant TxO interaction again points to the influence of the Order II presentation with these Ss in both the Silent and Vocal conditions improving across blocks of trials in contrast to the Order I Ss.

Although Underwood (1957) has demonstrated the importance of proactive inhibition (PI), the reduction in latency and the increase in correct responses in the Order II three-second condition is difficult to explain these terms (Tables 2 & 4). If we consider only the no-interference conditions (Figures 1 & 2) we find that the curve for the condition with both the least proactive and least retroactive interference (Order I three-seconds delay) falls below the curve for the Order II three-second condition. The latter curve should be reduced instead by accumulating proactive inhibition. In the three-second Order I condition, some proactive inhibition is involved, since the three-second no-interference condition preceded it, but the amount should not be as great as that in the Order II three-seconds interference condition. Yet the mean CR for Order II three-seconds Silent is 7.13 as compared to 4.63 for the Order I three-seconds condition. The same comparison in the Vocal condition shows means of 6.75 and 7.25 (Table 2).

Cofer & Davidson (1968) approach the problem of PI in a study using retention intervals of three and 18 seconds by comparing the correct responses for the first trials only. They found no differences in retention of single consonants or trigrams for this first test, but a greater forgetting over trials two to six for the trigram, suggesting that PI was operating during the later trials. A similar comparison was made in this study examining first trial correct responses for both orders of presentation for the three and 18 second conditions and found no difference (χ^2 NS). Instead of comparing all subsequent trials where small differences might accumulate to a significant level, a comparison was made of only the last trial and again χ^2 showed no significant differences.

This does not rule out the possibility that PI is involved, but points to the possibility of an interaction with other variables. Two considerations are important. One is the possibility that by not randomizing the presentation of retention intervals, subjects were provided with a "set" by the presentation of a short retention interval first or the presentation of a long retention interval first. Order I subjects expected a short time between stimulus and recall. On the other hand, in the Order II condition, subjects expected to hold the stimulus term in memory longer and were, therefore, able to produce the responses under the shorter retention condition.

Ellis (1963) has hypothesized that retardates have a short-term memory deficit. In forcing subjects to acquire a "set" for holding material in memory for a longer period of time, perhaps we have forced them to utilize a longer storage memory system which functions better for retardates than the short-term memory system.

The second consideration is one of practicality. Longer retention intervals in the beginning of a session of programmed instruction might enhance retention across all trials for MR's.

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Table 1

Analysis of Variance of Correct Responses

Source	SS	df	MS	F	p
Total	241.96	95			
Between Groups	68.46	31			
V	30.38	1	30.38	49.00	.01
O	16.67	1	16.67	26.89	.01
VxO	4.16	1	4.16	6.71	.05
S/VxO	17.25	28	0.62		
Within Groups	173.5	64			
T	10.90	2	5.45	1.95	NS
TxV	4.56	2	2.28	1.0	NS
TxO	1.64	2	0.82	1.0	NS
TxVxO	0.15	2	0.08	1.0	NS
S/TxVxO	156.25	56	2.79		

Table 2

Means and standard deviations for correct responses in seconds per S in the three blocks of eight trials.

	Blocks of Eight Trials					
	1		2		3	
Condition	M	SD	M	SD	M	SD
SOI	4.63	2.20	4.75	2.55	5.50	1.85
SOII	5.88	1.13	5.63	1.30	7.13	0.99
VOI	6.75	1.16	6.25	0.46	6.50	1.07
VOII	7.00	1.31	6.50	1.20	7.25	0.46

Table 3

Analysis of Variance of Response Latency

Source	SS	df	MS	F	p
Total	37641.74	95			
Between Groups	10789.93	31			
V	2562.83	1	2562.83	12.86	.01
O	1093.50	1	1093.50	5.49	.05
VxO	1553.43	1	1553.43	7.79	.01
Sw/VxO	5580.17	28	199.28		
Within Groups	26851.81	64			
T	1726.42	2	863.22	2.27	NS
TxV	353.46	2	176.73	<1	NS
TxO	3013.41	2	1506.70	3.97	.05
TxVxO	486.88	2	243.44	<1	NS
Sw/TxVxO	21271.64	56	379.85		

Table 4

Means and standard deviations for response latency in seconds per S over responses in each Block of eight trials. In Order I the interference intervals go from 3 - 9 - 18 seconds. The order of interference intervals is reversed in Order II.

Blocks of Eight Trials

	1		2		3	
Condition	M	SD	M	SD	M	SD
SOI	49.63	20.64	48.18	30.09	48.25	29.22
SOII	38.25	15.38	44.18	14.21	19.56	13.65
VOI	20.88	14.50	35.69	12.96	34.43	13.94
VOII	39.25	12.73	36.06	13.94	19.25	9.90

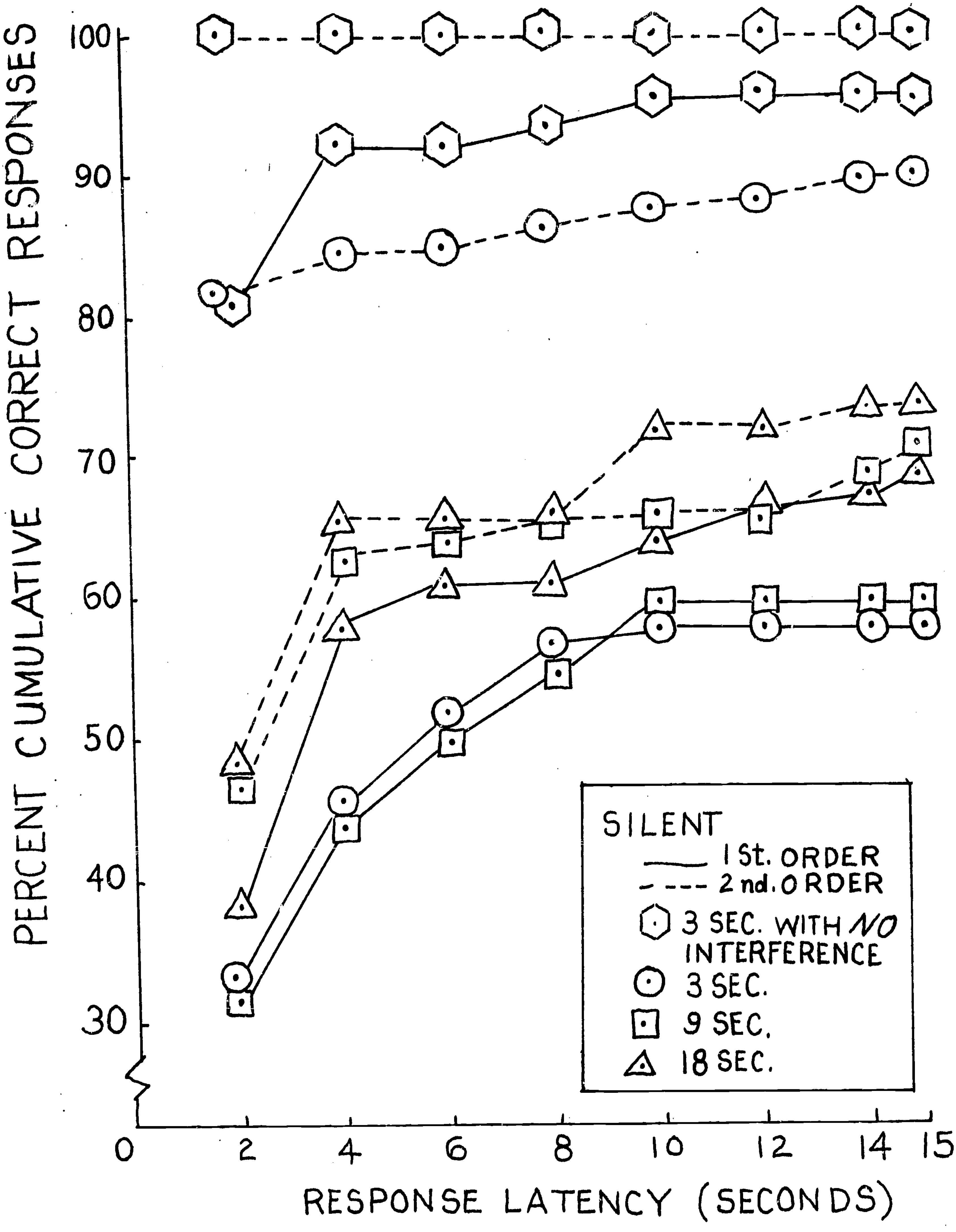
PERCENT CUMULATIVE CORRECT RESPONSES
100
90
80
70
60
50
40
30
0
2
4
6
8
10
12
14
15
RESPONSE LATENCY (SECONDS)
SILENT
1 St. ORDER
2 nd. ORDER
3 SEC. WITH NO INTERFERENCE
3 SEC.
9 SEC.
18 SEC.

FIG. 2

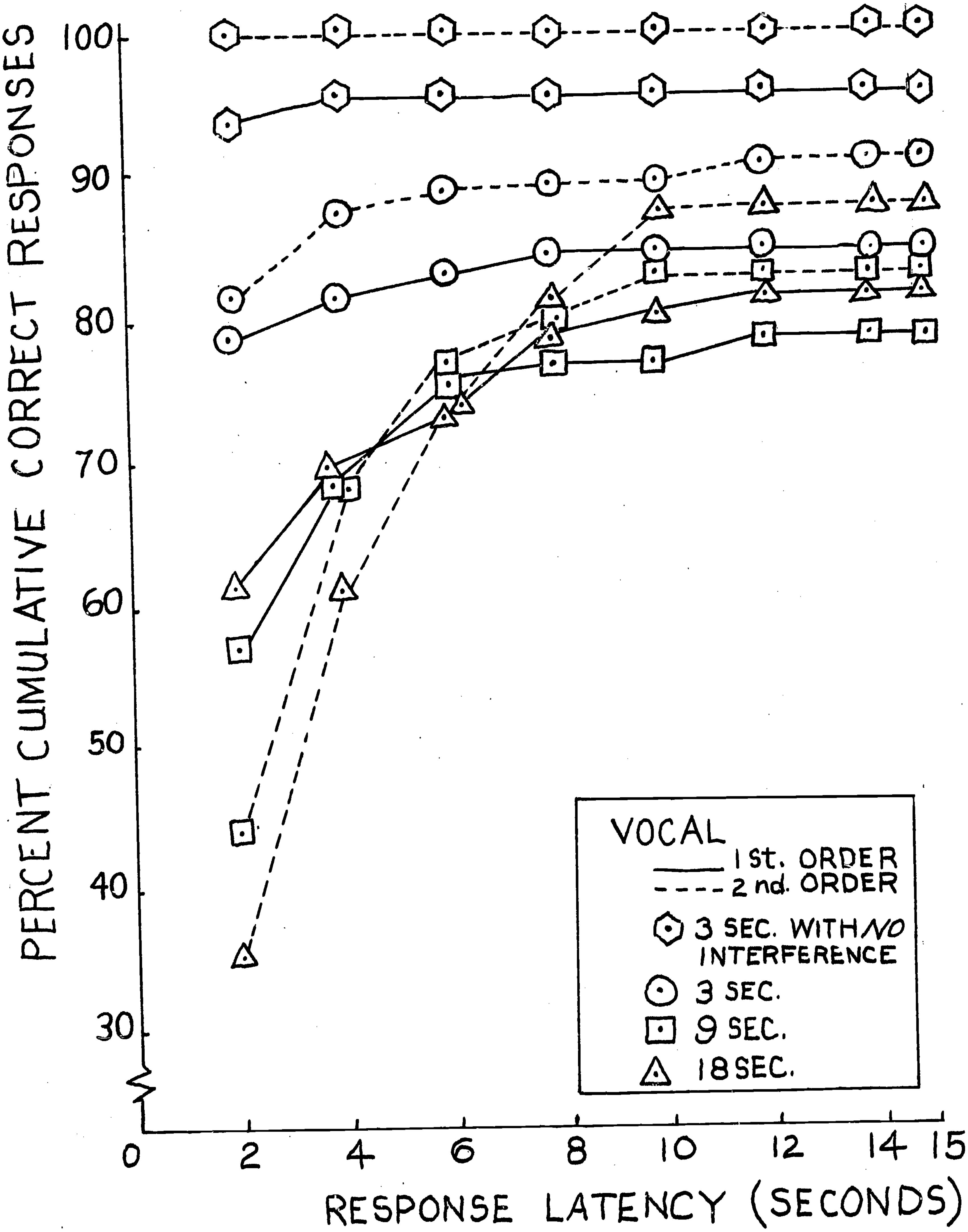
PERCENT CUMULATIVE CORRECT RESPONSES
100
90
80
70
60
50
40
30
0
2
4
6
8
10
12
14
15
RESPONSE LATENCY (SECONDS)
VOCAL
1 st. ORDER
2 nd. ORDER
3 SEC. WITH NO INTERFERENCE
3 SEC.
9 SEC.
18 SEC.

FIG. 1